condition, is represented by the difference in the heat contents at the steam-engine stop valve and exhaust divided by the boiler efficiency expressed as a percentage.

The thermodynamic efficiency of the machine under these conditions of working cannot be measured by the ratio of work performed expressed in heat units to heat units available in adiabatic expansion, but as the ratio of work performed to the sum of work performed and heat lost in direct radiation and the heating of lubricating oil. For all losses resulting in re-heating the steam can be utilized in the heating system. It follows that under such conditions the measurement of the steam consumption of the turbine or engine in pounds of steam per horse-power hour does not give an indication of the efficiency, and although a back-pressure reciprocating engine will generally show to advantage in the matter of such steam consump-tion, the turbine may be the more economical prime mover on account; of its reduced radiation losses. The absence of oil in the exhaust steam is often a deciding factor in favour of a turbine.

Fig. 46 shows a single-stage impulse turbine of Messrs. Frascr & Chalmers' manufacture, specially designed for small outputs and well adapted for use as a back-pressure turbine for driving pumps and other auxiliary machinery where it is desired to use the low-pressure steam for feed-heating purposes. It will be seen that the machine illustrated is compounded for velocity, although under certain steam conditions a single blade row is employed.

The casing consists of two high-grade cast-iron portions jointed hori-zontally and bolted together. The bottom half of the casing is provided with a substantial foot on either side, and also carries the bearing brackets which are bolted to the casing. The steam admission and exhaust openings are arranged in the top half of the casing.

The type of blades, design of bearings, and other essential features follow the makers' standard practice already described, a special feature of the design being the method of governing.

Close to the main oil-pump at the high-pressure end of the shaft a similar

pump is fixed which performs the functions of a governor. The supply from this pump is taken to a governing cylinder containing a piston loaded by an adjustable spring. As the oil supply of the governor pump is practically nil, the delivery pressure varies with the square of the speed of the turbine. This variation in oil pressure is utilized to operate the piston in the governing cylinder, which in its turn moves the piston valve admitting oil to or releasing oil from underneath the power piston of the governing valve. The speed of the turbine can be varied by altering the tension of the spring in the governing cylinder by means of a hand-wheel. A lever connects the spindles of the governing piston, piston valve, and power piston, and therefore to every position of the governor piston corresponds a definite lift of the governing valve.

The retention of relay governing is somewhat exceptional in a small-power turbine of this kind and ensures very close governing.